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The torque of the drag cup motor utilized in the float suspension creep instrument was fairly sensitive to the position of the aluminum drag cup in the motor's magnetic field; an axial displacement of 0.1 mm led

to a one per cent change in the torque. In the construction of a similar torque producing device for the levitation instrument the drag cup was redesigned by eliminating as much metal from the fringe magnetic field as was practical. The torque dependence on axial displacement is now virtually nil. Over the range of possible motion the torque varies a maximum of 0.2 per cent. Before public disclosure of the properties of this device is made, we wish to make one attempt at verifying an hypothesis as to the source of the inversion point in the torque temperature coefficient.

Measurements on two different samples of polyvinyl acetate, PVAc, have been carried out at temperatures up to 155°C without any sensible sign of degradation. Measurements in the levitation instrument are routinely made either in a fore pump vacuum (about 10 microns of Hg) or in an atmosphere of high purity nitrogen under slight positive pressure. An attempt at 200°C was frustrated by serious outgassing of the sample. At present this is assumed to reflect serious material degradation. One of the two PVAc samples was investigated previously at temperatures between 40° and 84°C in the float instrument. At the different temperatures measurements were made over three to five and a half decades of time. All of the curves exhibited a sufficient amount of curvature so that it is possible to distinguish between the vertical and horizontal shifts required to achieve temperature superposition. The necessary vertical shifts are somewhat at variance with that predicted

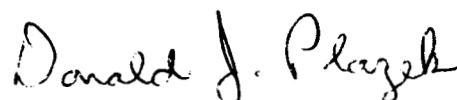
by rubberlike theory. Although the discrepancies are believed to be beyond the possible experimental errors, they will have to be corroborated by measurements in the levitation instrument. To achieve this, measurement of the sample height in this instrument will have to be improved. The necessary modifications are being made. Both samples are fractions from low conversion stock with molecular weights of 7.80×10^5 and 6.5×10^5 respectively. In spite of their proximity in molecular weight, the viscosity of the former is far greater. It is suspected that the former, being polymerized at a higher temperature, may be somewhat branched. Known branched fractions as well as other linear fractions have been kindly made available by Dr. Guy Berry, here at Mellon Institute, to check this possibility. Such discrepancies, as mentioned above, have been reported earlier, but have yet to be widely accepted as true. Whereas the viscosities vary a great deal, there appears to be very little difference in the retarded elastic component of the creep. If these initial conclusions are confirmed they should be of significant influence in future theoretical treatments.

Normal molding techniques, we believe, lead to the dissolution of air present in a conventional mold thereby introducing oxygen into the sample which enhances oxidative degradation at high temperatures and also lead to bubble formation at these temperatures even if degradation is negligible. To minimize these undesirable effects, vacuum molds have been designed and fabricated. Good results have been obtained in the preparation of short cylinders of polyvinyl acetate and polystyrene.

Dynamic mechanical properties of a fractionated and annealed sample of linear polyethylene are being made in collaboration with Drs. Markovitz and Birnboim in the forced oscillation torsion pendulum. Measurements have been made between -55° and 25°C . The results at frequencies between 5×10^{-4} and 5 cycles per second appear to be excellent and have been confirmed at 5 cps. with free oscillation determinations. Between 5 and 100 cps. the results are in error. The source of the discrepancies is being investigated.

Additional swelling measurements on the rubber samples have been made. Some swelling measurements in chlorinated solvents have also been made on a series of low density polyethylene samples which have been provided by Dr. Robert Kratz of the Koppers Chemical Company. It is hoped that these measurements may shed some light on the molecular weight of amorphous chains between crystallites.

In this coming grant period we hope to complete the work on polyvinyl acetate and finish the initial investigations on the Hevea and polybutadiene rubbers. The polycrystalline polymer work will also be continued.



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